OBITUARY NOTICES OF FELLOWS DECEASED.

David Thomas Ansted was born in London on the 5th February, 1814, and after education at a private school, entered the University of Cambridge as a member of Jesus College. He was 32nd Wrangler in the year 1836, and proceeded to the degree of M.A. in due course. About four years afterwards he was elected to a fellowship on the Ley Foundation in his College, which he retained for about eight years. In 1840 he was elected Professor of Geology at King's College, London, which office he resigned in 1853. He was also for some time Lecturer on Geology at Addiscombe, and Professor of Geology at the College of Civil Engineers, Putney. From 1844 to 1847 he was Vice-Secretary of the Geological Society, of which he became a Fellow in 1838. He was elected to the Fellowship of the Royal Society in 1844.

By degrees his attention became diverted from the theoretic to the practical aspect of his favourite study, and for the last thirty years at least of his life he acted professionally as a consulting geologist and mining engineer. For some time before his death he was in failing health, and he expired on the 13th May, 1880, at his residence, Melton, near Woodbridge, Suffolk.

Professor Ansted, however, when systematic teaching ceased to be a part of his regular duties, did not abandon his interest in geology as an educational subject, but not unfrequently lectured and took part in examinations on this and allied sciences. His pen also was rarely for long idle. Besides some contributions to the "Quarterly Journal of the Geological Society," the "Transactions of the Cambridge Philosophical Society," the "Annals and Magazine of Natural History," and other like publications, he was whole or part author of a considerable number of volumes; the majority of these were of a somewhat popular character, and more than one obtained a considerable share of success. He wrote lucidly and pleasantly whether upon matters more directly scientific or upon the incidents of travel. Among these works may be mentioned the following:—"Geological Gossip," first published in 1860; "A Short Trip to Hungary and Transylvania," in 1862; "The Ionian Islands," in the year 1863; and "The Great Stone Book of Nature," published in the same year. He also published a work on geology, in two volumes, in 1844, and more than one smaller book on this subject, physiography, or geography. He was joint author (with Mr. R. G. Latham) of a work on "The

Channel Isles," and wrote, in 1866, upon the "Physical Geography and Geology of Leicester." In the Great Exhibitions of 1851 and 1862 he contributed to the "Reports." His latest and one of his most important works was on "Water and Water Supply," published in 1878. Though for several years, owing to pressure of business and the advance of age, he had ceased to take an active part in the proceedings of the scientific societies of which he was formerly an energetic member, he did not lose that cordiality of manner and kindliness of disposition, which have left a pleasant impression on the memory of his friends.

William Hallowes Miller was born, April 6, 1801, at Velindre, near Llandovery, in Carmarthenshire. At this pretty spot, on the upper part of the strath of the Towey, his father, Captain Miller, had a few years previously fixed his residence. The associations of the family were essentially military. Captain Miller served through a part of the American War; his house was burnt by the rebels, and he was in other respects a heavy loser. All the family papers were destroyed in this conflagration; but Captain Miller is believed to have been a descendant of a distinguished officer who was Adjutant-General to General Wolfe. He was twice married. Of his family by the first wife, two sons were killed in action—one in the act of leading a storming party; another, though crippled by wounds, lived to be a Lieutenant-Colonel, and to receive the distinction of C.B. His daughter also married an officer in the Artillery. Captain Miller, after his return to England, and comparatively late in life, for he was then full sixty years of age, married the daughter of a Welsh clergyman. She was the mother of William Hallowes Miller, and died a few days after his birth.

After receiving his earlier education at private schools, he proceeded to St. John's College, Cambridge, and in the year 1826 graduated, being fifth among the Wranglers in the Mathematical Tripos. In the earlier part of 1829 he was elected a Fellow of his College, and proceeded in due course to the degree of M.A. For some time he filled the office of a College tutor, and his first literary work was mathematical—a "Treatise on Hydrostatics," published in 1831, and followed a few years subsequently by one on "Hydrodynamics." The two were afterwards republished in one volume, and formed for many years the chief text-book on that subject in the Cambridge lecture-rooms. This treatise is conspicuous for its exactness and lucidity, though its terseness—a distinguishing feature in all the author's writings—makes it a rather difficult book for a student of only average ability. At this time, the Chair of Mineralogy at Cambridge was occupied by Dr. Whewell, who, on his election to that office in the year 1828, had thrown himself energetically into its duties, and had especially de-

voted himself to the study of crystallography. Miller was attracted to the same subject; and four years later, when Professor Whewell resigned, he used his influence to obtain the chair for his pupil. Thus, in the year 1832, Miller was elected to the post, the duties of which became the chief work of his long and laborious life.

In 1838 Professor Miller was elected a Fellow of the Royal Society. In 1841 he proceeded to the degree of Doctor of Medicine. To this temporary diversion from more congenial studies he was compelled by the statutes which at that time governed the College. These required that all the Fellows, after a certain time, should be in Holy Orders, with the exception of four, two of whom were to be students of medicine. To one of these Fellowships Professor Miller was transferred in the year 1834; but it is needless to add that, though he complied with the requirements of the statute, he made no attempt to follow medicine as a profession. In 1844 he vacated his Fellowship at the College, by marriage, in accordance with the existing statutes. However, thirty years afterwards he was again elected a Fellow of his old College, under the statute (granted in 1860) empowering the Society to elect as Fellows persons eminent for science or learning, though in other respects technically disqualified. But Professor Miller's work was now drawing near its end. From his youth he had been a hard worker, and had lived perhaps almost too sparingly. He delivered his lectures as usual in the earlier part of 1876, but a change in the expression of his face began to be rather marked, which seemed to forebode a giving way of his robust constitution, and caused anxiety to his friends. Their fears were not groundless. In the October term of 1876 a short course of lectures which he had announced was interrupted by a slight stroke of paralysis. This proved the beginning of the end. He was never able to meet his class again, and the duties of the chair were henceforth discharged by a deputy. Very slowly, but very surely, his vital powers declined—a torpor stealing alike over mind and body—till at last he fell asleep on the 20th May of the present year (1880).

Professor Miller's name is inseparably connected with two important branches of scientific work. The first of these belongs, as might be expected, to mineralogy. "Crystallography," as it has been said, "was Miller's science. It had taken its first shape in the hands of Haüy in the decade of years before he was born, and in those of Weiss, of Mohs, and especially of Franz Ernst Neumann and of Grassmann; it had been receiving development during the years of Miller's youth and manhood." To this his predecessor, Professor Whewell, had contributed by an important memoir on the geometrical treatment of crystal forms, published in the "Transactions of the Cambridge Philosophical Society." "Taking this memoir and Neumann's treatise of 1823 ('Beiträge zur Krystallonomie') as his starting point,

Miller proceeded to develop a system of crystallography, which was not published till 1838, but which was the most important work of his life." His system represented the face of a crystal by a symbol composed of three numerals, or indices. Selecting three crystallographic axes, parallel respectively to possible edges of a crystal, and a face of that crystal making certain intercepts on these axes, and taking the three simplest whole numbers (a, b, c, suppose) whose ratio expressed the ratio of these intercepts, he expressed the ratio of the intercepts of any other face of the crystal, by multiplying a, b, c respectively by $\frac{1}{h}$, $\frac{1}{k}$, $\frac{1}{l}$ respectively, where h, k, l were integers, and formed the symbol of the new plane.

"The elegant way" (to continue the words of Professor Maskelyne, already quoted) "in which this mode of representing a face lent itself to yielding expressions for the relations between faces belonging to a zone (*i.e.*, faces that would intersect in edges parallel to the same line) gave it a superiority over previous methods, due to its bringing the symbols of the crystallographer into a form similar to that employed in algebraic geometry. Miller's work consisted in working out into a beautiful system the indicial method of notation and calculation in crystallography, and obtaining expressions adapted for logarithmic calculations by processes of great elegance and simplicity. Miller's system, then, gave expressions for working all the problems that a crystal can present, and it gave them in a form that appealed at once to the sense of symmetry and appropriateness of the mathematician." He thus, as it has been well said, "placed the keystone into the arch of the science of crystallography," and the "future development of that science, there can be little doubt, will follow on the lines laid down by Miller."

Professor Miller's shorter communications on mineralogy and physics are numerous and valuable, and, in addition to them and to his original treatise, he published, in 1863, a tract on crystallography. In 1852 a work appeared entitled a new edition of the "Elementary Introduction to Mineralogy, by the late William Phillips," by H. J. Brooke and W. H. Miller. It is, however, no disparagement to either the original author or his fellow editor to say that Professor Miller made this volume almost his own. As has been said by the authority quoted above, "The publication of this severe little volume was an epoch in the science which it illustrated; it contained a mass of results obtained by Miller with all his accuracy and all his patience through many years, and tabulated in his usual concise manner. It is a monument to Miller's name, though he almost expunged that name from it."

But Professor Miller's reputation does not rest only upon his work as a mineralogist, great though that was. His name is no less in-

separably connected with the difficult and delicate experiments and investigations connected with the restoration of the standards of measurement and weight, and with the subsequent labours of the International Metric Commission.

After the fire which, in 1834, consumed the Houses of Parliament, it was found that the standards of measurement and weight there preserved were hopelessly ruined, and a Commission was appointed to consider the questions connected with their restoration. Professor Miller was not, indeed, a member of that Commission, but it is well known that his friendly assistance contributed greatly to guide the Commission in some of their more important recommendations, especially in those which related to the means to be provided for contingent restoration of the standard of weight. In sections 3 and 5 of the Act 5th George IV, it was directed that "in case of the loss of the standard, the yard shall be restored by taking the length which shall bear a certain proportion to the length of the pendulum, vibrating seconds of mean time in the latitude of London, in a vacuum, at the level of the sea; and that the pound shall be restored by taking the weight which bears a certain proportion to the weight of a cubic inch of water weighed in a certain manner." In their report, dated December 21, 1841, the Commissioners decline to recommend the adoption of these provisions, for reasons which are given therein, and advise that each standard should be restored from measures and from weights then existing, which had been most carefully compared with the original standards, stating also that they were "fully persuaded that, with reasonable precautions, it may always be possible to provide for the accurate restoration of standards by means of material copies, which have been carefully compared with them, more securely than by reference to experiments referring to natural constants."

In 1843 a Committee was appointed to superintend the construction of the new Parliamentary standards of length and weight, of which Professor Miller was a member, and to him was confided the construction of the new standards of weight. In the "Philosophical Transactions" for 1856 he describes at length "The operations for restoring the value of the Old Standard of Weight, for constructing the New Standard of a different value, for constructing various derived Standards, and for establishing the relative value of the Kilogramme," a paper which (to quote the words of the Astronomer Royal, endorsed by a former President of this Society, Sir Edward Sabine) "will long be cited as a model of accuracy."

He was subsequently a member of a new Royal Commission for "examining into and reporting on the state of the secondary standards, and for considering every question which could affect the primary, secondary, and local standards."

In the year 1870 he was appointed a member of the Commission Internationale du Mètre. This led to various visits to Paris between the above year and 1874. More than one of his colleagues has expressed in the warmest terms his sense of the value of Professor Miller's services to that Commission. Perhaps there was no member whose opinions had greater weight in influencing a decision upon any intricate and difficult question.

His services to this Society must not be forgotten in a sketch of his life, however brief. Elected a Fellow in the year 1838, he was appointed Foreign Secretary in 1856, a post for which he was eminently fitted by his accurate and extensive knowledge of French, German, and Italian, his methodical habits, and unvarying courtesy, as well as by his extensive scientific knowledge.

To those who enjoyed Professor Miller's friendship three characteristics were conspicuous above all. One was the extent and the accuracy of his knowledge. Not only on those subjects to which he had more notably devoted himself, but on almost any question of physical science he was an authority. Younger men in Cambridge looked upon him as a kind of living encyclopædia, for their questions were at once met by answers, clear, accurate, and concise. As one of the most competent judges now living in that University writes, "There was, I think, no person in Cambridge whose knowledge of natural philosophy on the whole exceeded, or even equalled, that of Professor Miller. He kept up his reading to an extent that was surprising."

Another was the simplicity of his disposition. Seldom has there been a man with so few wants. To all except himself he was generous; hospitable to his friends, he was almost Spartan in his own habits. This trait combined with the remarkable inventiveness of his mind, is evidenced even in his laboratory. There the visitor is surprised to find the most homely odds and ends utilised in the construction of instruments capable of performing delicate measurements. "Give Professor Miller," a friend has said, "some loose lenses, bits of glass tubing, laths, copper wire, and especially some pill-boxes, and he will make any instrument that he wants."

The third characteristic was the remarkable combination which he exhibited of independence of thought and freedom of opinion, with gentleness of temper and speech, with forbearance, courtesy, and respect for the opinion of others. No one, however conscious of inferiority, whether in experience or in mental powers, had any reason to fear to speak in the presence of Professor Miller. His words were sure to be received with consideration, often almost with deference, beyond their deserts.

His life's course was tranquil and full of quiet happiness. Until his last illness he enjoyed excellent health. Year after year was spent in the labours—to him a pleasure—which have been briefly noticed, with

an occasional visit to the Continent, either for duty or for relaxation. He delighted especially in the scenery of the dolomite mountains of the Italian Tyrol, spending among them many hours of quiet enjoyment, while their magnificent outlines were recorded with rare fidelity by the accomplished companion of his life.

Happy, then, in his domestic life, happy in the affectionate appreciation of numerous friends of varied ages and ranks, he was also happy in seeing his work (though for honours and rewards he cared less than most men) not unacknowledged by his contemporaries. In addition to the honours mentioned above, he received in 1865 the degree of LL.D. from the University of Dublin, and in 1876 that of D.C.L. from Oxford. In 1870 he was awarded a Royal Medal by this Society. He was a Knight of the Order of St. Maurice and St. Lazare of Italy and of the Order of Leopold of Belgium. He was also an honorary member of the Royal Society of Edinburgh, of the Mineralogical Society of France, and of Boston, U.S.A., a foreign member of the Mineralogical Society of St. Petersburg, of the Imperial Royal Academy of Sciences, Vienna, and of the Royal Society, Göttingen; and a corresponding member of the Academies of Berlin, Munich, Paris, St. Petersburg, and of Turin.

William Lassell, LL.D., died at Maidenhead, October 5, 1880, aged eighty-two years. He was born at Bolton, Lancashire, June 18, 1799. He acquired the rudiments of education at a day school in his native town, during which time his father died, and thence went for eighteen months to an academy at Rochdale.

In 1814 he entered a merchant's office at Liverpool, and there served a seven years' apprenticeship. He commenced business in Liverpool as a brewer about the year 1825, without, however, much taste or inclination for trade, and spent almost all his leisure time in his favourite pursuit of astronomy and the mechanics connected therewith.

Mr. Lassell possessed a great love and aptitude for mechanical invention, and for this reason "he belonged," to use the words of Sir John Herschel, "to that class of observers who have created their own instrumental means, who have felt their own wants, and supplied them in their own way." The qualities which enabled Mr. Lassell to do all this made him what he was. The work was the revelation of the man. He felt precisely where lay the difficulties and wants which met him in his work, because he was sensitive and sympathetic. He could deal successfully with these difficulties and supply these wants often in a masterly and original way, because he could think for himself cautiously yet boldly. He could work out his conceptions in new and difficult directions to a successful issue, because the constancy of his character showed itself here in concentration of thought and perseverance of

action. These qualities—sensitive sympathy, wise prudence, constancy —were those which pre-eminently characterised him as a man, and made him to those who knew him a friend of rare worth.

In the history of science Mr. Lassell's name will rank with those of Herschel and the late Lord Rosse in connexion with that essentially British instrument, the reflecting telescope, whether we consider the genius and perseverance displayed in the construction of these instruments or the important discoveries which have resulted from their use. About 1820 Mr. Lassell, then in his twenty-first year, began to construct reflecting telescopes for himself. It is perhaps to circumstances which he at the time considered unfavourable, that science is indebted for much that Mr. Lassell has accomplished. At that time he did not possess sufficient means to enable him to purchase expensive instruments, and besides "his business avocations were such as most men consider of an engrossing nature." The value to him in his subsequent work of the energy and power of resource which were in this way so strongly developed in his character at an early age, it is difficult rightly to appraise. His success with the first two instruments, which he attempted simultaneously (a Newtonian of seven inches diameter and a Gregorian of the same size), encouraged him to make a Newtonian of nine inches aperture. The instrument, which was erected in an observatory at his residence near Liverpool, happily named Starfield, may be said to form an epoch in the history of the reflecting telescope, in consequence of the successful way in which Mr. Lassell, on a plan of his own, secured to it the inestimable advantages of the equatorial movement. The several mirrors made for this instrument were of great excellence. The observatory note-books of the late Mr. Dawes, which are in the writer's possession, bear record to the delicate tests for figure to which these mirrors were put on the occasions of the frequent visits of Mr. Dawes to his friend's observatory. With this instrument Mr. Lassell diligently observed, and detected, without knowledge of its existence, the sixth star in the trapezium of the nebula of Orion. This instrument is fully described in the twelfth volume of the "Memoirs of the Royal Astronomical Society."

About the year 1844 Mr. Lassell conceived the bold idea of constructing a reflector of two feet aperture and twenty feet local length, to be mounted equatorially on the same principle. He spared neither pains nor cost to make this instrument as perfect as possible, both optically and from the mechanical side. As a preliminary step, he visited the late Earl of Rosse at Birr Castle, and commenced the specula for the new instrument upon a machine similar in construction to that employed by that nobleman. After some months' work, he was not satisfied with this apparatus, and was led in consequence to contrive a machine for imitating as closely as possible those motions of the hand by which he had been accustomed to produce perfect surfaces on

smaller specula. "The essential difference of these constructions," to use the words of Sir George Airy, "as regards the movements of the grinder is this: that in Lord Rosse's apparatus every stroke is very nearly straight, while in Mr. Lassell's apparatus there is no resemblance to a straight movement at any part of the stroke." This is not the place to describe the many new contrivances in the mode of support of the mirror, in the equatorial mounting, in the polishing machine, and in the arrangements of the dome under which it was erected, which enabled Mr. Lassell to bring his telescope to a high degree of perfection. In this connexion it should be noticed, to use Sir John Herschel's words, "that in Mr. Nasmyth he was fortunate to find a mechanist capable of executing in the highest perfection all his conceptions, and prepared by his own love of astronomy and practical acquaintance with astronomical observations, and with the construction of specula, to give them their full effect."

With this fine instrument he discovered the satellite of Neptune. This minute body was seen on October 10th, 1846, but it was not until the next year that it could be satisfactorily followed, and its existence fully confirmed. The superiority of the telescope, and the vigilance and skill of the observer were further shown by the discovery in 1848, simultaneously with Professor Bond in America, of an eighth satellite of Saturn, of extreme minuteness, which was named Hyperion. In 1851, after long and careful search, he discovered two additional satellites of the planet Uranus (Umbriel and Ariel), interior to the two discovered by Sir William Herschel in 1787.

In the autumn of 1852, he took this twenty-foot telescope to Malta, and observed with it there through the winter. A very careful and detailed drawing of the nebula of Orion, and drawings of several planetary nebulæ made at Malta, will be found in vol. xxiii of the "Memoirs of the Royal Astronomical Society." With respect to the planets, his discoveries, to use his own words, "were rather negative than otherwise," for he was satisfied, that without great increase of optical power, no other satellite of Neptune could be detected. With regard to Uranus, he says, "I am fully persuaded that either he has no other satellites than the four, or if he has, they remain yet to be discovered."

Mr. Lassell's energy and zeal in the cause of science did not permit him to remain content with this magnificent telescope. His last work was a much larger telescope, four feet in aperture, and thirty-seven feet focus, mounted equatorially, which was erected at Malta, in 1861. The work done with it, with Mr. Marth's assistance, during the next four years, is fully described, as well as the instrument itself, in vol. xxxvi of the "Memoirs of the Royal Astronomical Society." This work consists of numerous observations of nebulæ and planets, and a catalogue of the places of 600 new nebulæ

discovered at Malta. It is not possible to suppress a feeling of regret that this grand instrument no longer exists.

Mr. Lassell was very successful in the great brilliancy and permanence of polish of his mirrors. Within the last few years the writer has been shown specula by Mr. Lassell, which had been polished for more than twenty years, and which appeared as bright as if but just removed from the polishing machine. His earlier metal differed from that employed by Lord Rosse, in that it contained a small quantity of arsenic in addition to copper and tin. In the case of his four-foot mirrors, the arsenic was omitted. He seems to have considered that the perfection of the metal depended upon the accurate relative proportion of the copper to the tin, and that, in consequence of the uncertainty of the state of purity of the metals, this proportion would be obtained with the necessary accuracy only by a series of testings, while the metal was in the pot.

After his return from Malta, Mr. Lassell purchased a residence near Maidenhead, and erected there in an observatory, his equatorial telescope of two-foot aperture. Mr. Lassell's experience in re-polishing his four-foot mirror, suggested to him some alterations in his polishing machine. After his return, he was able to carry out experiments in connexion with the suggested alterations in a workshop erected at Maidenhead, and succeeded in constructing an improved form of polishing machine, which is described in the "Philosophical Transactions" for 1874. The numerous papers by Mr. Lassell, to be found in the "Monthly Notices," and the "Memoirs" of the Royal Astronomical Society, bear abundant record to his industry and skill, and make us feel that in Mr. Lassell's death we have to deplore the loss of one who contributed largely to the advancement of the science of his age.

Mr. Lassell was elected a Fellow of the Royal Astronomical Society in 1839, he received the Gold Medal of that Society in 1849, and in 1870 was elected its President, which office he held for two years. He became a Fellow of the Royal Society in 1849, and received one of the Royal Medals in 1858. Among other honours conferred upon him, may be mentioned an honorary degree from the University of Cambridge, and the honorary Fellowship of the Royal Society of Edinburgh, and of that of Upsala.

Dr. William Sharpey was born at Arbroath, in Forfarshire, Scotland, on the 1st of April, 1802. His father was an Englishman and belonged to Folkestone, in Kent, till the year 1794, when he migrated to Arbroath, and there married Mary Balfour, a native of that place; but, he dying shortly before the birth of his son William, Mrs. Sharpey was afterwards married to Dr. William Arrott, a medical practitioner of Arbroath, in whose family the subject of this notice was brought up.

William Sharpey's education was carried on up to the age of fifteen at the public school of Arbroath. In November, 1817, he entered the University of Edinburgh as a student in the Faculty of Arts, attending the Greek and Natural Philosophy classes.

In 1818 he commenced his medical studies, in the University and the extra-academical school of Edinburgh. In the latter school his teacher in anatomy was Dr. John Barclay, well known for his energy as a writer and lecturer and his ingenuity as an observer in human and comparative anatomy. In chemistry his chief instructor was Dr. John Murray, of whose scientific accuracy and judgment Dr. Sharpey always spoke in the warmest terms. In 1821, at the age of nineteen, he obtained the diploma of the Edinburgh College of Surgeons. He then passed some months of that year in the study of anatomy at Brookes' School in London, and in the autumn proceeded to Paris and remained there for nearly a year, in attendance upon the medical and surgical wards of the hospitals, more especially in the surgical wards of the Hotel Dieu, under the instruction of the celebrated Dupuytren. In Paris he had the companionship of his friend Dr. Robert Willis, and he first made the acquaintance of Professor Syme, with both of whom he was ever after on the most intimate and friendly terms.

In August, 1823, he took the degree of Doctor of Medicine in the University of Edinburgh, his printed inaugural dissertation bearing the title "De Ventriculi Carcinomate;" and in the latter part of the year he went again to Paris to complete his studies in medicine and surgery at the hospitals, and in natural history at the Garden of Plants. After his return from France in the summer of 1824, his plans seem to have remained for some time undecided until near the end of 1826, when he finally resolved not to embark in medical practice, but to devote himself to anatomical and physiological pursuits, for which he had long had a predilection, and to the study of which he had already given a considerable share of attention.

With this view he resolved upon completing his continental travels, and obtaining the advantages of study in the Italian and German schools, as he had already done very fully in the French; and accordingly, in the autumn of 1827, he proceeded by way of Paris and Geneva to Switzerland, in which he made a three months' pedestrian tour. He then travelled in the north of Italy, visiting Milan, Pavia (where he spent some time in company with Panizza), Genoa, and Florence. The winter was passed in Rome, Naples, and other places of interest in central Italy; and in the spring of 1828 he turned his steps northward, taking the way of Bologna, Padua, and Venice, to Verona and Innsbruck. The summer was spent in Austria and North Germany, and he finally reached Berlin in August, where it was his main object to devote himself to the study of anatomy. In

doing this he had the inestimable advantage of the assistance and friendship of Professor Rudolphi; and for nine months he gave the whole of his time with the closest application to the minute and full dissection of the human body,—the only way, as he himself expressed it, in which any one could obtain the knowledge necessary to a competent teacher of the subject.

As already mentioned, Dr. Sharpey made considerable parts of his foreign travels on foot, with his knapsack on his back, picking up acquaintance with fellow travellers as he went, mixing with the natives of the several places he visited, and storing up in his wonderfully tenacious memory that fund of observation, anecdote, and incident, which always surprised and delighted those who afterwards heard him narrate his travels.

On his return from the Continent, in the autumn of 1829, he established himself in Edinburgh, and engaged in microscopic observation and scientific anatomical research; and, in 1830, as a necessary preliminary to his being qualified as a teacher, he obtained the Fellowship of the College of Surgeons, and presented a probationary essay "On the Pathology and Treatment of False Joints" (after fracture); a subject which was no doubt suggested by his intimacy with Mr. Syme, to whom the printed essay is inscribed. In the summer of 1831, Dr. Sharpey again spent three months in Berlin, on this occasion being chiefly employed in collecting anatomical preparations and other materials for the illustration of the course of instruction in anatomy which he had in view to deliver in the following winter. This long-cherished object he carried into effect by giving, during the session of 1831–32, a course of systematic lectures on anatomy in the extra-academical school of Edinburgh in association with Dr. Allen Thomson, who taught physiology. This association subsisted during the four following years of Dr. Sharpey's stay in Edinburgh. At this time a keen competition existed among the four teachers who, in addition to the Professor within the University, divided among them the students who applied for instruction; and as Dr. Sharpey's class increased during the period mentioned from twenty-two to eighty-eight, we may regard his success as complete in point of number, while his reputation as a teacher and man of science had advanced in a still greater degree, so that he had now come to be generally known both in the seat of his labours and at a distance as one of the most judicious, learned, and accurate investigators and teachers of his favourite science.

From 1829 to 1836, Dr. Sharpey was also actively engaged in scientific investigations; among which the earliest and perhaps the most novel and important were those on ciliary motion, described in a paper published in 1830 ("On a peculiar Motion excited in Fluids by the surfaces of Certain Animals," "Edin. Med. and Surg.

Journal," vol. civ, 1830). By the observations which were described in this paper, many of which were entirely new, Dr. Sharpey appears to have been the first to point out distinctly the general distribution among animals, and the essential nature and uses of the phenomena of ciliary motion; and although it is true that he afterwards found he had been anticipated in one of the most important of his observations, and that at the time of his first publication, from the want of a sufficiently powerful microscope, he was unsuccessful in detecting the presence of cilia in the Batrachia, his later observations led to that result, and his observations on a number of animals greatly amplified and confirmed the general conclusions which followed from the important discovery by Purkinje and Valentin in 1834, of the existence of cilia in vertebrate animals.

In 1835, Dr. Sharpey published in "The Edinburgh New Philosophical Journal," a translation of the preliminary memoir in which the discovery of Purkinje and Valentin was announced, and at the same time gave an account of additional observations on the subject made by himself; and he soon afterwards embodied the whole of the information on Cilia and ciliary motion in a systematic form in his article "Cilia," published in the "Cyclopædia of Anatomy and Physiology," in 1836, but which he had been engaged in preparing for several years previously.

Dr. Sharpey also contributed the article "Echinodermata," which appeared in the same publication in 1837, and which, like that of "Cilia," contained a large amount of original matter, and added greatly to his scientific reputation.

In 1833 he published an abstract of Ehrenberg's discoveries on the Infusoria in "The Edinburgh New Philosophical Journal." In 1834 he took an active part in the proceedings of the Meeting of the British Association at Edinburgh, and communicated a paper founded on his own observations on the peculiar convoluted disposition of the blood-vessels in the common porpoise.

In 1834, Dr. Sharpey was elected a Fellow of the Royal Society of Edinburgh.

We now come to the period of Dr. Sharpey's career when he was about to be called to a wider sphere of exertion in the metropolis. In the summer of 1836, upon the resignation by Dr. Jones Quain of the chair of Anatomy and Physiology in the then University of London, a desire was felt by the leading professors and authorities of that institution to give greater prominence than had previously been done in the London schools of medicine to the subjects of physiology and physiological anatomy, and, after due inquiry, Dr. Sharpey was, in the course of July, selected as the fittest person to fill the chair and carry out the object in view. He was accordingly appointed to the chair designated as of Anatomy and Physiology, while Mr.

Richard Quain was named Professor of Anatomy; it being determined that Dr. Sharpey should in his course treat fully of physiology, or of the functions of the body along with minute and visceral anatomy, and that Professor Quain should occupy himself with the descriptive and practical departments of anatomy. There was thus established in London, for the first time, the full and systematic teaching of physiology, which had previously been only imperfectly treated as an appendage to the courses of anatomy in the London medical schools.

The great success of Dr. Sharpey as a teacher in his favourite departments of biology was from the first apparent in the large number of his pupils, the close attention and deep interest with which he was listened to, and the marked influence which he exercised on the minds of the students, and in all the affairs of the school with which he was now connected. With all the interests of University College, as it was named after the institution of the London University, he soon became identified, while at the same time he took an active part in the business of other scientific bodies of the metropolis.

Dr. Sharpey never wrote out his lectures, excepting an introductory one, and he delivered them all without any assistance from writing beyond very short jottings on small slips of paper. He made use of diagrams and pictorial illustrations as well as of anatomical preparations and physiological experiments, and he was one of the first to introduce the employment of the microscope for the practical illustration of his lectures. For this purpose he employed more than forty years ago a revolving table which still exists in the physiological laboratory of University College, and which enabled a number of persons in succession to observe through one microscope; the first attempt made in London to illustrate physiological lectures microscopically. And thus in later times, when the improvement of the apparatus and methods of experimenting had become greatly extended, he lent all his influence to the establishment of the practical teaching in physiology which has since been so fully carried out in the Jodrell Laboratory for practical physiological experiment and research.

Dr. Sharpey's course of instruction was continued much in the same form during the long period of thirty-eight years in which he held the chair; the same scrupulous care in the preparation of his lectures, and the same conscientious performance of his public duties which he had shown in the earlier and most vigorous periods of his life being maintained to the last; and when we consider the number of those who followed his instructions, varying, with the fluctuating numbers attending the school, between 100 and 350 in each year, the wide-spread influence of his teaching can easily be understood. Many

of his pupils now hold high and important positions in the medical profession and in other departments of science; and all of them are ready to acknowledge, and none more emphatically than the most distinguished among them, their debt of gratitude to their biological teacher, not alone for the exact and solid information which they derived from his instructions, but also for the scientific spirit and love of truth which he endeavoured to instil into their minds.

Dr. Sharpey was by no means a copious writer; and indeed, it may be said that from his extreme fastidiousness with regard to all that emanated from his pen, he was much too sparing of authorship. Accordingly, much of the original observation and thought on scientific subjects which cost him prolonged labour, and involved much research, was made known by him only through his lectures, or was published in a more or less fragmentary form in connexion with such systematic works as "Baly's Translation of Müller's Physiology," and "Quain's Anatomy." In the first of these works, it is well known that the excellent translator, who was a distinguished pupil of Dr. Sharpey's class, derived much assistance in his labours from his teacher; and several notable additions were made to the work by contributions from Dr. Sharpey's pen. Among these, one of the most important is that taking the modest form of a note, in which he gave an account of original observations made by himself on the structure of the uterine glands and membrana decidua, and brought forward the first rational explanation of the manner in which the human ovum comes in the commencement of pregnancy to be imbedded in the substance of the decidua. In 1843–46, Dr. Sharpey published, as joint editor with Professor Richard Quain, the fifth edition of Dr. Jones Quain's "Elements of Anatomy," which, from the amount of new matter introduced, and changes made by the editors, assumed almost the character of a new work. In this edition, the general anatomy was entirely re-written by Dr. Sharpey, and has ever since been looked upon as a standard work on the subject of which it treats, containing the record of a large number of original observations upon the minute structure and growth of bone, and on many other subjects. "The Anatomy of the Brain and Heart," "Of the Organs of Respiration and Voice," "Of Digestion and Reproduction," were also from his pen. With the three subsequent editions of this work, Dr. Sharpey remained connected as one of the editors till the time of his death.

In 1862, Dr. Sharpey delivered the "Address in Physiology," at the thirtieth annual meeting of the British Medical Association, held in London in that year; and, as President of the Biological Section of the British Association for the Advancement of Science, at the Dundee Meeting in 1867, he delivered an address, in which, as in the one previously mentioned, he ably reviewed the progress of physi-

ology, more especially as regards the application of exact methods of research to the investigation of physiological problems.

Dr. Sharpey was appointed one of the examiners in anatomy to the University of London, when that body obtained its charter to grant degrees in 1840, and continued to perform the duties of the office during the long period of twenty-three years. He was, at a later period, a Member of the Senate of the University. He was also during fifteen years one of the members appointed by the Crown on the General Council of Medical Education and Registration. He acted for some time as one of the Treasurers of the Council, and took a deep interest in the various subjects connected with medical education and polity, which claimed its attention. Dr. Sharpey was also a member of the Science Commission, which met under the presidency of the Duke of Devonshire, from 1870 to 1875, and, taking an active part in its proceedings, he aided greatly by his sagacity and knowledge the deliberations of that body. He was also one of the Trustees of the Hunterian Museum of the Royal College of Surgeons, and a member of many scientific societies of this and other countries. He received the honorary degree of LL.D. from the University of Edinburgh in 1859.

Dr. Sharpey's connexion with the Royal Society began by his election as Fellow, on the 9th of May, 1839. He became a Member of the Council in 1844–5, and was appointed one of the Secretaries in place of Mr. Bell in 1853. This office he held for nineteen years, or till 1872, when the failing condition of his eyesight, obliged him to resign. He was again chosen a Member of Council for the next two years.

All those who attended the Society, or took part in its proceedings, are well aware of the strong and steady interest which Dr. Sharpey took in all its affairs, and of the great amount of anxious care and judicious labour which he devoted to the promotion of its welfare. In the course of so long a membership and official connexion with the Society, there were necessarily many incidental pieces of business in which he was particularly engaged. It is sufficient to mention as among the more important of those which occupied his attention, the following, viz.:—1. The correct and speedy publication of the Society's Proceedings and Transactions which fell under his superintendence. 2. The introduction, in 1848, of the mode of electing Fellows, by which the Council is made primarily responsible for the selection of the persons to be elected by the Society. 3. The removal of the Society with its library and other property from Somerset House to Burlington House, in 1857, and the subsequent transference to the new apartments in that locality. 4. The compilation and publication of the Society's Catalogue of Scientific Papers, in which his extensive and accurate knowledge of scientific literature enabled him

to render most important assistance. It may be further mentioned, that in 1870, along with other members of the Society, he was active in the introduction of a new plan for the election of Councillors, by which effect was given to the opinion of the whole Council, instead of the members being nominated by the President as previously.

Up to the age of sixty-eight or seventy, Dr. Sharpey retained most of the vigour of his earlier years; but about the year 1871, and still more decidedly in the following year, while some other signs of advancing age showed themselves in the partial failure of his digestive and locomotive powers, the rapid increase of a cataract, which affected both eyes, together with some dulness of hearing, began to interfere seriously with the efficient and easy performance of his official duties, and to take much from his pleasure in society; and very soon these affections led to his retirement, first, as already stated, from the Secretaryship of the Royal Society, in 1872, and second, from his Professorship in University College, in 1874. These infirmities were partially remedied by the operation of extraction of the lens of the left eye, in May, 1873, and of that of the right eye in October, 1876; but the recovery was not sufficient to give him more than a very limited use of his sight.

About the same time, Dr. Sharpey became subject to occasional attacks of bronchitis, from exposure to cold. One of these, occurring in 1878, was of great severity, and in the present year a renewed attack of the same malady with which he was seized at the end of March proved fatal on the 11th April, or ten days after he had completed his seventy-eighth year. He was buried in the Abbey graveyard of Arbroath, his native town, on the 17th of April, and on the day of the departure from London, his remains were accompanied by a large number of his friends and former pupils to the Euston Station of the North-Western Railway.

In 1869 the friends and former pupils of Dr. Sharpey, being desirous to carry out a design which had been for some time in contemplation of showing their regard for him, and establishing a permanent memorial of his services to University College and to science, raised by subscription a sum of money for endowing a Sharpey Memorial Scholarship in connexion with University College, and for presenting to the college a portrait in oil, and a marble bust. The proceedings in connexion with the presentation of this memorial were naturally a source of much gratification to himself and to his friends.

In 1872 he made over his large and well-chosen biological library to University College, and at his death he bequeathed from the small property which he left a sum of £800 to increase the endowment of the Sharpey Scholarship in physiology.

Upon his retirement from his Professorship in 1874, Mr. Gladstone's Government accorded Dr. Sharpey an annual pension of £150 on

account of his eminent services as a public teacher and man of science.

From what has now been said it will be seen that Dr. Sharpey did not enter upon any active sphere of exertion, either as an investigator or as a teacher, till he had attained his twenty-eighth year; but with characteristic caution he was, during a number of years, preparing himself with the greatest diligence and care, by literary and scientific study, as well as by continental travel, for the duties of his after life.

As a scientific investigator he was characterised by scrupulous care and accuracy in all his observations, and by an extensive and intimate acquaintance with what was previously known on the subjects. Thus it happens that though, as already remarked, he cannot be regarded as a copious observer or extensive discoverer of new facts, yet all the observations he has recorded may be ranked as important contributions to science at the time when they were made, and the greater number of them have retained their value to the present day, notwithstanding that the subjects to which they belong may, from the advance of knowledge, have considerably changed their aspect.

As a systematic author there is everywhere apparent in his writings the same scrupulous accuracy and full knowledge of his subject, combined with a simplicity and clearness of statement, an appropriate choice of language, and a critical acumen, which have given them a high and lasting value. We have, it is true, to regret the fastidiousness which deterred him from more copious publication, but we may console ourselves with the reflection that all he did publish bears the stamp of excellence, and that in abstaining from more extended literary productions he was ever spending his time and energies in the instruction of his pupils and the advancement of the business of the scientific institutions with which he was connected.

Dr. Sharpey's usefulness and influence were probably more conspicuous in his labours as a public teacher than in any other capacity. During the forty-three years in which he was constantly occupied in giving lectures on Anatomy and Physiology, he devoted himself with ardour and perseverance to perfecting the information which he had to communicate to his pupils, and to extending and improving the means of illustrating his lectures, so that he was uniformly listened to with the closest attention and regarded as the highest authority on the subjects which he taught. Thus too, it happened that he was very frequently consulted by former pupils as well as by others with regard to the preparation and publication of memoirs or more extensive works which they had in contemplation, and it is easy to understand the advantages which accrued to those who appreciated and followed his advice, or the opposite effect which sometimes occurred from its being disregarded.

But the effect of Dr. Sharpey's teaching upon a large number of pupils did not proceed alone from the superiority of the information conveyed, or the implicit reliance which his pupils placed in the fulness, accuracy, and truthfulness of the statements of their teacher, but it was also due to, and greatly enhanced by, the feeling of friendly attachment, and even of filial affection amounting to reverence, which was inspired in the minds of the pupils by his uniform kindness, justice, and candour.

In the other public offices held by Dr. Sharpey during the greater part of the time of his residence in London, the superior qualities of his mind had equal scope in conducing to the efficiency and usefulness of his services. As an examiner in the University of London and afterwards as a member of the Senate, as Secretary of the Royal Society, as Member of the General Medical Council, as one of the Science Commissioners and a trustee of the Hunterian Museum, his extensive knowledge, unbiassed judgment, and strict impartiality, while they gave weight to his opinions and suggestions, aided largely in the promotion of measures favourable to the interests of science and the public good.

Of the more private features of Dr. Sharpey's life and character it is difficult for those who have been most intimate with him to express their estimate in sufficiently moderate terms. While he was universally admired for the extent and accuracy of his acquirements and respected for the soundness of his judgment, he was not less esteemed and beloved for the gentleness of his disposition, the kindness of his heart, and the geniality of his nature. His powers of memory, naturally good, were carefully cultivated by the systematic turn of his mind and strengthened by exercise. His friends remember with delight the readiness with which, in the course of conversation, he could call up a desiderated quotation, or supply a fact on some doubtful point in history, philosophy, or science, or tell humorously some anecdote which was equally apposite and amusing. He had not a single enemy, and he numbered among his friends all those who ever had the advantage of being in his society.

John Stenhouse, the son of William Stenhouse and Elizabeth Currie, his wife, was born at Glasgow, 21st October, 1809, and educated first at the Grammar School, and subsequently at Glasgow University, where he studied from 1824 to 1828.

His tastes in early life were more literary than scientific, but owing to weak eyesight he was obliged to give up literature as a pursuit, and devoted himself to Chemistry, which he studied under Professor Graham and Dr. Thomas Thomson. His training in this science was first acquired at the Andersonian University, now Anderson's College, Glasgow, and it was probably on this account he always took such a

lively interest in this Institution: during his lifetime he used all his interest to obtain bursaries and otherwise promote the study of his favourite science, and by his will he left a legacy to found a Scholarship in connexion with the Chemical Chairs in that College.

He attended the Chemical lectures at Glasgow University in 1837, 1838, and 1839, and shortly afterwards left Glasgow for Giessen, where he continued his chemical researches under Liebig, and became acquainted with many of his fellow pupils, whose names have since become illustrious as workers in this portion of the field of science. It is apparently shortly before this time that his first paper, entitled "Darstellung und Analyse des Hippursäures Æthers," was published in the "Annalen der Chemie und Pharmacie," vol. xxxi, p. 148 (1839). He was with Liebig, at Giessen, about two years, and then returned to Glasgow, where he remained until the failure of the Glasgow Commercial Exchange deprived him of the fortune bequeathed him by his father, which had hitherto rendered him independent.

Stenhouse received his degree of LL.D. in May, 1850, and it was about this time that he was an unsuccessful candidate for the Professorship at Owens College. He left Glasgow for London in January, 1851, and in the following month was appointed Lecturer on Chemistry to the Medical School at St. Bartholomew's Hospital, but was obliged to resign the appointment in 1857 owing to a severe attack of paralysis. He then went to Italy, and resided there with his mother until her death, which took place at Nice in February, 1860. He returned to England in June of the same year, and again commenced scientific research with that indomitable energy which was so characteristic of him, and which enabled him to overcome the obstacles occasioned by his bodily infirmities.

In 1865 he succeeded Dr. Hofmann as one of the non-resident Assayers to the Royal Mint, but was deprived of the appointment when the office was abolished in 1870. In November, 1871, a Royal Medal of the Royal Society was awarded to him for his long-continued chemical researches, which have proved of great value in the arts and manufactures.

During the last four years of his life he suffered greatly from rheumatism in the eyelids, which compelled him to live almost constantly in a darkened room, and at times caused him the greatest pain. It was not, however, until within a few weeks of his death that he became sensibly feebler; he ultimately sank into a sleep, and died a painless death from old age and decay of nature in the early morning of the 31st December, 1880, in the seventy-second year of his age. He was buried on the 6th of January in the High Church New Cemetery in Glasgow, on the north side of the Cathedral.

Dr. Stenhouse was one of the few surviving founders of the Chemical

Society, a Fellow of the Institute of Chemistry, an honorary member of the Berlin Chemical Society, as also of the Philosophical Society of Manchester, and the Pharmaceutical Society of Great Britain.

It will be evident from an inspection of the titles of the numerous papers (more than 100 in number) published by Dr. Stenhouse during the past forty years, in the Transactions and Proceedings of the Royal Society, the "Journal of the Chemical Society," "Liebig's Annalen," and other scientific journals (either alone or in conjunction with Mr. C. E. Groves), that these for the most part relate to what may truly be called "Organic Chemistry," the chemistry of compounds found in organised bodies, so that his name will long be associated with numerous carbon compounds obtained from plants, and derivatives formed from them. Among all these he applied himself chiefly to the principles from the lichens, and made known the results in eighteen papers. One of his communications, published in 1880, is worth mention as it relates to "Betorcinol," a substance he had discovered some thirty-two years previously. It is but seldom that a chemist lives to complete a work begun so long before.

Although the eminence he attained in organic research is fully recognised, his contributions to our technical knowledge are not so generally known. He was the author of many ingenious and useful inventions in dyeing, waterproofing, sugar manufacture, and tanning; but the greatest and most permanent benefit has been conferred by his application of the powerful absorbent properties of wood charcoal to disinfecting and deodorising purposes, which took the form of charcoal air-filters and charcoal respirators.

Of Dr. Stenhouse's personal character, those who knew him intimately could never speak too highly, his general conversation and fund of anecdote rendering him a most pleasant companion. His ingenuity and quick perception were remarkable, and this combined with his unflagging industry, and patience and resignation in great bodily suffering, enabled him to continue his scientific work with unabated vigour, even after the effects of paralysis prevented him from performing experiments with his own hands.

Humphrey Lloyd was born in Dublin on the 16th of April, 1800. His father was the Rev. Bartholomew Lloyd, afterwards Provost of Trinity College, Dublin, at that time a Junior Fellow. Having received his early education at Mr. White's school in Dublin, he entered Trinity College on July 3, 1815, obtaining at the Entrance Examination, which was at that time altogether classical, first place among sixty-three competitors. He obtained Scholarship (Classical) in 1818. At the examination for the degree of B.A. he obtained the Science Gold Medal, the highest honour which could be gained by an undergraduate. In the year 1824 he obtained a Fellowship, given then, as

now, to the best answerer at a special examination. He was elected, in 1831, to the chair of Natural and Experimental Philosophy, which he filled with distinguished ability till 1843, when he became a Senior Fellow. In the year 1862 he became Vice-Provost, and in 1867, when the Provostship became vacant by the death of Dr. Macdonnell, he was chosen by the Government of the day to fill the place. He continued to discharge the duties of this important office with unwearied assiduity till his death, which occurred, after a few days' illness, on the 17th of Jannary, 1881.

Dr. Lloyd was President of the Royal Irish Academy from 1846 to 1851, and on the visit of the British Association to Dublin, in 1857, he was elected to the Presidency of that distinguished Society.

In 1856 the University of Oxford conferred on him the degree of D.C.L., *Honoris Causa*, and in 1874 he received from the Imperial Government of Germany the Cross of the Order "Pour le Mérite."

Dr. Lloyd's most important contributions to science were made in the departments of optics and magnetism. It will be convenient to consider these subjects separately, taking the contributions to each subject respectively in the order of time.

His first contribution to optical science was a systematic work on plane (as distinguished from physical) optics. It was entitled "A Treatise on Light and Vision," and was published in the year 1831. This book possesses a high scientific value.

The year 1832 was distinguished in Dr. Lloyd's life by, perhaps, his most remarkable single scientific achievement, namely, the experimental proof of the phenomenon of conical refraction. The discovery of conical refraction presents one of the instances—rare in the history of physical science—in which theory was able not merely to account for a phenomenon but to predict it. Reasoning mathematically on the theory of Fresnel, and giving a suitable physical interpretation to the mathematical results which he obtained, Professor (afterwards Sir William) Hamilton deduced the remarkable consequence that, in certain cases, the two rays into which an incident ray is usually divided by a crystal are replaced by an infinite number of rays, forming a luminous cone or cylinder. Anxious to submit this extraordinary result to the test of experiment, he requested Dr. Lloyd to undertake the experimental investigation of the phenomenon. It would be impossible to give here a detailed account of the difficulties attendant upon this inquiry. Suffice it to say that they were overcome by the experimental ability of Dr. Lloyd, who succeeded in giving a perfect experimental demonstration of this remarkable phenomenon in both its varieties. He also established experimentally the law by which the polarisation of the rays composing the luminous cone is governed.

This successful investigation at once brought Dr. Lloyd to the front

rank among the cultivators of optical science, and in the year 1833 he was requested by the British Association to report on the condition of physical optics. The report prepared in compliance with this request was laid before the British Association in the year 1834, and may be regarded as a handbook of the progress of the science to that date.

Shortly after the publication of the experiment which established the reality of conical refraction, Dr. Lloyd described to the Royal Irish Academy an important experiment upon the interference of light proceeding directly from a luminous source with light coming from the same source, but reflected at a very high angle of incidence from a plane surface. By means of this experiment he was able to make an important contribution to the theory of reflected light. The phenomena of thin plates require us to admit that a semi-undulation is gained or lost by the light in the process of reflexion at one of the surfaces. But these phenomena do not decide the question whether this modification takes place at the surface of the rarer or of the denser medium. Dr. Young had given the preference to the former of these alternatives ; but Dr. Lloyd derived from the above-mentioned experiment a strong argument in favour of the other. The details of this experiment are published in the seventeenth volume of the "Transactions of the Royal Irish Academy."

In 1836 Dr. Lloyd published the first part of his lectures on the "Wave Theory of Light," including the phenomena which are independent of polarisation and double refraction. To this was subsequently added a second part in which the phenomena of polarisation are discussed.

A communication received from Sir David Brewster, detailing some remarkable appearances which he had observed in connexion with the phenomena of thin plates, induced Dr. Lloyd to turn his attention to that subject, the light incident on the plate being supposed to be polarised. A communication on this subject was made by him to the British Association in 1841, but the complete investigation of the phenomenon was published in the twenty-fourth volume of the "Transactions of the Royal Irish Academy," having been laid before that Society in 1859.

Assuming the truth of Fresnel's expressions for the intensity and phase of polarised light reflected from the surface of an ordinary medium, Dr. Lloyd showed that the reflected light is elliptically polarised. He assigned the law of this elliptic polarisation, which passes into plane polarisation where the incident light is polarised in, or at right angles to, the plane of incidence. He also gave the explanation of the phenomena observed by Brewster, where the index of refraction of the plate is intermediate between those of the bounding media.

But it will probably be felt that the link which associates Dr. Lloyd's

name most indissolubly with the science of the nineteenth century is to be found in the subject of terrestrial magnetism. It is here that his labours, whether conducted singly or in association with other investigators, have left the most permanent mark; and it is not too much to say that no single individual contributed more largely to the success of the effort which was made to perfect by observation our knowledge of the earth's magnetic force.

At the first meeting of the British Association in 1831, the Committee of Section A reported that it was highly desirable that a series of observations upon the intensity of terrestrial magnetism in various parts of England be made by some competent individual, similar to those which had been recently carried on in Scotland by Mr. Dunlop. In compliance with this suggestion, some experiments were made in the neighbourhood of Liverpool, by W. S. Traill, M.D., the results of which were laid before the Association in 1832. In 1833 the Committee extended their recommendation so as to include the whole kingdom, appointing as a Standing Committee, charged with the promotion of these objects, Professors Christie, Forbes, and Lloyd. At the same time Dr. Lloyd undertook to make the required observations in Ireland. These observations were carried on in the year 1834 by Dr. Lloyd, with the assistance of Captain (afterwards Sir Edward) Sabine, and subsequently of Captain (afterwards Sir James) Ross. A brief communication on the method of these observations was made by Dr. Lloyd to the Association in 1834. In this communication he described a new method of obtaining the values of the intensity and the dip, by observation of a magnet turning round a horizontal axis. This method had been previously communicated to the Royal Irish Academy by Dr. Lloyd (October, 1833) and is published in the seventeenth volume of their "Transactions." A full report of observations made at twenty-four stations in various parts of Ireland was laid before the British Association in 1835, and is published, along with a magnetic chart of Ireland, in the Report for that year. This was followed, in 1838, by an elaborate memoir, "On the Magnetic Survey of Great Britain," from the pen of Major Sabine, embodying the results of observations made by several distinguished physicists, including Dr. Lloyd.

In the same year the Association came to the conclusion that a wider scope ought to be given to the inquiry, by establishing stations for *simultaneous* magnetic observations in various parts of the world. As it was impossible for private individuals to carry out so extensive a plan, it was resolved to endeavour to obtain the co-operation of the Government, and a Committee, consisting of Sir J. Herschel, Dr. Whewell, Mr. Peacock, and Dr. Lloyd, was appointed for this purpose. The representations made by this Committee, strongly backed by the Royal Society, were successful, and Magnetic Observa-

tories were erected in various parts of the world. The high appreciation formed of Dr. Lloyd's scientific ability was proved by the fact that the duty of drawing up instructions for the observers at these several stations was intrusted to him. It was also provided that he should receive directly from the stations the reports of the observers. As a further proof of Dr. Lloyd's high reputation in this branch of science, it may be mentioned that the Director of the Magnetic Observatory at Cadiz visited Dublin for the purpose of consulting him as to the best methods of observing.

In the year 1837, Dr. Lloyd had induced the Board of Trinity College to commence the erection of a Magnetic Observatory within the precincts of the College. This observatory was completed in the year 1838, and observations were regularly carried on under his personal superintendence for several years. The instruments used in this observatory were constructed under the direction of Dr. Lloyd, and were in large part devised or greatly modified by him. Instruments similar in their construction to those used in the Dublin Observatory were subsequently employed in other observatories throughout the world. The observations made in Dublin were published in two quarto volumes in the year 1869. They form an important part of the great series of magnetic observations begun by an individual in Scotland—passing thence into the hands of a Society, and by them extended throughout the British Isles—taken up finally by the nation and extended over the world. No nation ever engaged in a more important scientific enterprise; no individual held a more prominent place in that enterprise than Dr. Lloyd.

Besides his share in this great public work, Dr. Lloyd was continually and actively engaged in his individual researches, the results of which were from time to time given to the world, generally in the "Transactions" or "Proceedings" of the Royal Irish Academy. Among these may be noticed a memoir "On the Mutual Action of Two Permanent Magnets," readbefore the Academy in February, 1839. The importance of this communication in its bearing on the question of terrestrial magnetism, was recognised by the Committee in their "Report to the British Association," in 1841. Besides optics and magnetism, Dr. Lloyd communicated to the Royal Irish Academy, from time to time, valuable papers on meteorology. In the year 1877, he published in a collected form, under the title "Miscellaneous Papers connected with Physical Science," his principal contributions to the Transactions of the British Association, and of the Royal Irish Academy. He also published in 1874, a systematic treatise on "Magnetism, General and Terrestrial." The third edition of his treatise on the "Wave Theory of Light" was published in 1873.

As head of the University of Dublin, Dr. Lloyd won golden opinions from all those who came into relation with him. His policy

was pure and liberal, guided by broad principles, and ever mindful of the greatness of the institution which he ruled. His University—his country—the world of science, will remember him long.

J. H. J.